



*The NITON 800 Series Multi-Element Spectrum Analyzer with bar code template and shielded belt pouch*



## Technical Demonstration Summary Sheet

### NITON® 800 SERIES MULTI-ELEMENT SPECTRUM ANALYZER (ALLOY ANALYZER)

#### THE NEED

A need exists at the Idaho National Engineering and Environmental Laboratory (INEEL) for in-situ, real-time analysis to identify the alloy and chemical composition of metallic materials. This in-situ, real-time analysis will provide the information needed

to segregate metal by recycling value, select cutting tools, identify metals with the potential for leaching RCRA metals (Cr), lower costs, and accelerate deactivation and decommissioning (D&D) activities. The current method involves collecting samples and shipping them to a laboratory for analysis. This costs over \$4,500 per sample and takes up to 3 months to receive the laboratory results.

#### THE TECHNOLOGY

The NITON 800 series analyzer uses X-ray fluorescence (XRF) spectrum analysis to identify and quantify elements in metal and then compares the readings to a built-in library to determine the alloy. The library contains 300 elements and alloys and can be customized. The basic unit uses a Cadmium-109 source, but each analyzer unit can hold up to two sources. In the future, Iron-55 and Americium-241 will be available as second sources. Iron-55 will provide greater sensitivity in the range between Silicon-16 to Chromium-24, and Americium-241 will provide greater sensitivity in the range between Rhodium-45 to Terbium-66. Pushing a safety button on the side of the unit and placing it against a surface opens the shutter window. The unit beeps at 5, 20, and 60-second intervals, and the results are displayed when the unit is removed from the surface. The longer the instrument analyzes a surface, the more accurate the analysis. The analyzer can store up to 1,000 data sets, including sample identification codes using a barcode reader. The data is easily downloaded to a conventional personal computer when sampling has been completed. The NITON 800 series analyzer is a surface scanner only, so contaminants of an alloy nature and coatings can effect the readings. Surface preparation from wiping the surface clean to scraping paint or grinding off a coating may be necessary to obtain an accurate reading. The NITON 800 series analyzer is an 8 x 3 x 2-in. hand-held, battery-operated unit. It weighs 2.5 pounds with a price starting at approximately \$28,000. Batteries are usable for 8 hours and can be charged in less than 2 hours. Conforming to 49 CFR 173.421, the NITON 800 series analyzer can be carried, shipped, or transported without exterior labeling.

#### THE DEMONSTRATION

The NITON 800 series analyzer was demonstrated in June 1999 at the INEEL as part of the Large Scale Demonstration and Deployment Project (LSDDP). It was used to characterize metal and to demonstrate the ability to make field identification for the segregation of scrap metal. The instrument self-calibrates on startup, but was checked periodically using Quality Assurance (QA) certified samples to ensure instrument accuracy. For the characterization portion of the demonstration and periodic instrument check against QA samples, the 20-second interval was used. For the field identification of material for segregation, the 5-second interval was used. After each portion of the

demonstration, the instrument data was downloaded to a personal computer. The instrument data was compared to drawings and other records containing information about the composition of the material. The instrument data was also compared to existing Certified Material Test Reports (CMTRs) when available.

#### THE RESULTS

The CMTRs confirmed the NITON 800 Alloy Analyzer element concentrations to be within acceptable limits. The



*The NITON Analyzer takes a reading on system piping in the Power Burst Facility basement at INEEL.*

#### CONTACTS

- Chelsea Hubbard, Project Manager, U.S. DOE-ID, (208) 526-0645
- Brad Frazee, Program Manager, INEEL, (208) 526-3775
- Steve Bossart, U.S. Department of Energy, Federal Energy Technology Center, DDFA (304) 285-4643
- Dick Mesurvey, Project Manager, INEEL (208) 526-1834
- Thomas Kuykendall, Test Engineer, INEEL, Applied Engineering & Development Laboratory (208) 526-0408
- James Passmore, NITON Corporation, Bend OR, (541) 388-0779
- John Pesce, NITON Corporation Bedford, MA, (781) 275-9275

**NITON 800 SERIES MULTI-ELEMENT SPECTRUM ANALYZER (ALLOY ANALYZER)**

<http://id.inel.gov/lsddp>

analyzer also correctly identified the alloy of known material 96% of the time. The analyzer determines the alloy by comparing selected element concentrations to its library of elements and alloys. The laboratory analysis process quantifies all of the elements of the periodic table, providing a more complete chemical analysis. The analyzer is user friendly, simple to operate, and easy to understand. The Data from the NITON 800 series analyzer is in % by weight concentration, which is the standard measurement for metal alloy composition.

#### BENEFITS

- \$28,000 for analyzer compared to over \$ 4,500 per metal sample
- 20 seconds to get a reading compared to 2 hours to get a sample
- Less than 1 minute compared to 90 days to get data
- Ability to make immediate decisions for cutting and removal methods
- Ability to identify metal with high salvage value for segregation during dismantlement
- Ability to immediately identify suspect material for salvage rather than disposed of as waste.

#### SUMMARY

The analyzer is a hand-held, battery operated unit, which uses x-ray fluorescence spectroscopy to quantify elements in metal and determine the specific alloy in metallic material. The baseline approach is to collect field samples and send the samples to a laboratory for analysis. Sample collection can take hours and analytical results from the laboratory may not be available for months. The analyzer provides results in about 20 seconds, and the data from the demonstration indicated that the NITON 800 series analyzer provides data comparable to laboratory data. With an average laboratory analysis cost per sample of about \$4,500, the NITON 800 series analyzer will pay for itself after measuring only 7 samples. These results can be used by the decommissioning project manager in making immediate decisions on the appropriate method to cut out and remove metal material, plus allow metal with high salvage value to be located and segregated during removal or at excess yards. Unknown suspect material that would normally be disposed of as waste can be identified at a reasonable cost for possible salvage. Due to its tremendous benefits, the Alloy Analyzer will likely be deployed immediately in the INEEL LSDDP and at other DOE sites.